LOAD TRIALS AND DEMONSTRATION OF TENSAR POLYMER GRID AS MINE SCREENING

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EXECUTIVESUMMARY

This report describes a series of tests conducted on Tensar polymer grid to determine its load carrying capacity as mine screening. The work was performed at the Val d'Or experimental mine of CANMET and testing was carried out by a method developed by the Ontario Ministry of (OMOL) 1983 (1). Results indicate that the polymer grid has a capacity to withstand a load of 2000 lbs f which is approximately 66% of the capacity of 4 in. x 4 in., 12 gauge weld wire mesh as reported by OMOL.

In addition, two demonstrations of applications of Tensar polymer grid are described. Firstly, its use as screening in the back where it was found to be a light, pliable material which was easier to install then weld wire. Secondly, it was used to construct a muck barricade beneath the brow of a raise, in this demonstration it again proved to be a material easy to work with and was able to contain muck dumped behind it.

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appmximate dimensions 10 ft x 10 ft

INTRODUCTION

Tensar polymer grid is a high strength polymer structure that has been used in civil engineering and construction for such things as slope reinforcement, retaining walls, road construction, gabions and drainage nets. Applications also exist in the mining industry for this product. The coal mining industries of Canada, Australia, the United States and the United Kingdom has made increasing use of this product for roof screening and shield recovery.

In the Canadian hard rock mining industry it competes with weld wire mesh and chain link mesh. Its strength compared to these traditionally used products is lower, but it has other advantages; namely, easy to install where conditions warrant and does not corrode.

This series of tests was conducted to determine the load carrying capacity of the polymer grid compared to its-competition and demonstrate some of its possible applications.

LOAD TEST PROCEDURE

The test procedure was based on the one used in the report "Load Tests on Mine Screening" by Pakalnis and Ames 1983 (1).

Weld mesh and Tensar polymer grid samples were attached to the wall with bolts installed in a staggered 4 ft pattern, Photo 1. The rockbofts, two feet long, 5/8 in. in diameter, and expansion shell anchors, held the polymer grid with 6 in x 6 in. plywood washers and 4 in. x 4 in. steel plate washers.

Load was applied to the samples by a 12 in. x 12 in. x 3/8 in. steel plate with rounded edges. The plate was pulled with a 3 ton chain block secured to the opposite wall of the drift, Photo 2. Measurement of the load was made with a 10 ton f tension meter calibrated with an error of less than a 1% full scale (20 lbs Displacement of the plate was measured to the

nearest millimetre by a stainless steel cable attached to the plate and run through a pulley on the opposite wall.

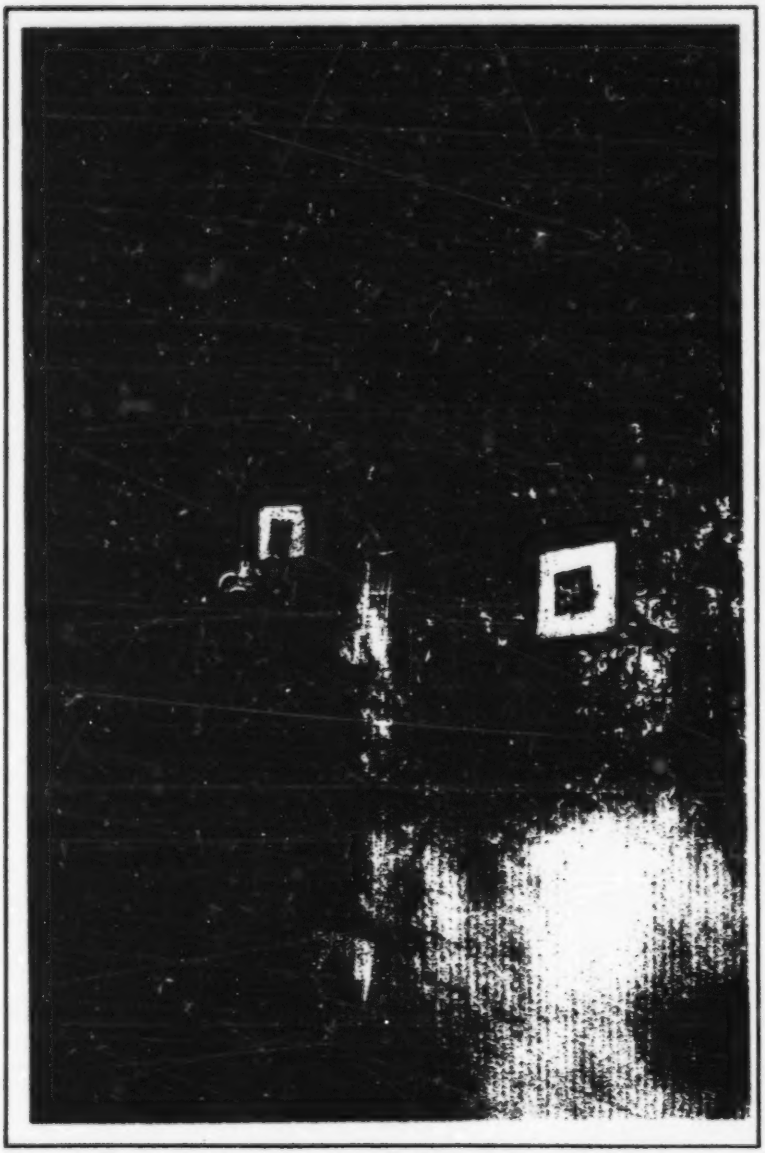

Photo 1 Test setup showing screen, bolting pattern and 12 in by 12 in plate

TEST RESULTS

Seven tests were conducted; six using polymer grid and one using 9 gauge weld wire mesh 4 in. x 4 in. The results of the tests on the polymer grid are shown in Fig. 1.

The curves are similar in shape increasing load as deflections increases. Ultimate loads range from 1400 lbs f to 2290 lbs f with a mean of 2000 lbs.

To verify that the test procedure was comparable to that used by OMOL, a sample of 9 gauge weld wire mesh 4 in. x 4 in. was tested. The results are shown in Fig. 2. The results compare favourably with the OMOL results for the same material. Ultimate strength obtained is within 150 lbs f for the two results. This indicates that the procedures used are comparable.

To compare the performance of the polymer grid, the curves for the polymer grid were averaged and this average is presented in Fig. 3. Tying between the curves of the 9 and 12 gauge weld wire mesh it can be ***seen*** that the polymer grid achieved approximately 45% of the strength of the 9 gauge weld wire (4in. x 4in) reported by the OMOL and 65% of the strength of the 12 gauge weld wire (4 in. x 4 in.).

DEMONSTRATION OF POLYMER GRID AS SCREENING MESH

To demonstrate this application, a length of polymer grid 13 ft x 60 ft was installed in an irregular back at the Val experimental mine, Photo 3. Although this is not a precise experiment, it is quite apparent from the demonstration that the lightweight and pliability of this material make it very easy to install. Drawing the polymer grid tight to the back can be done by hand, reducing the effort and time required for installation. It will also reduce the tendency for the ground to relax in areas where steel mesh cannot be drawn in tight.

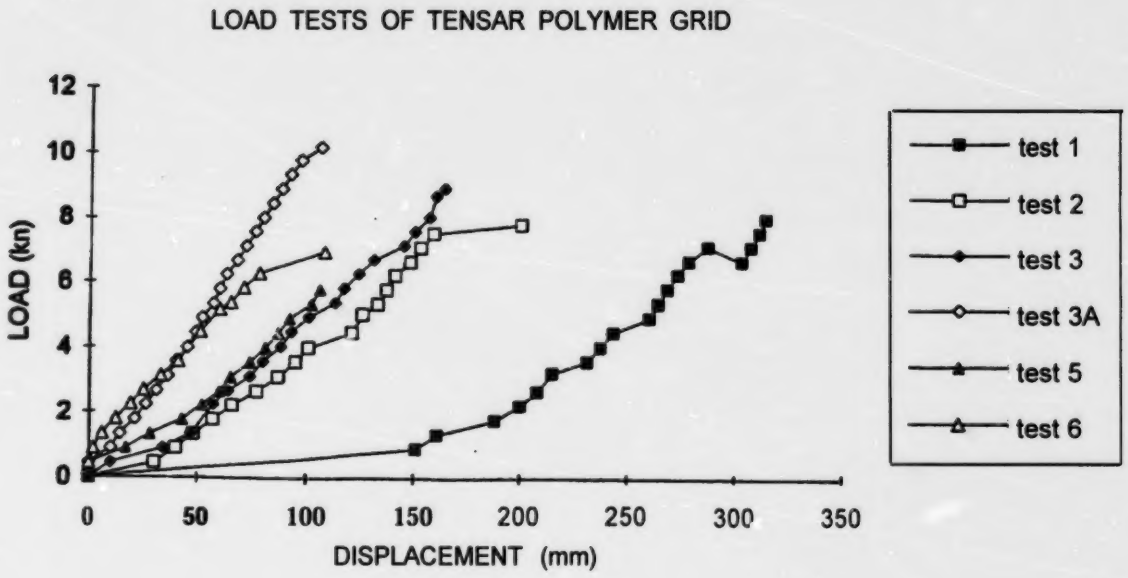

FIGURE 1

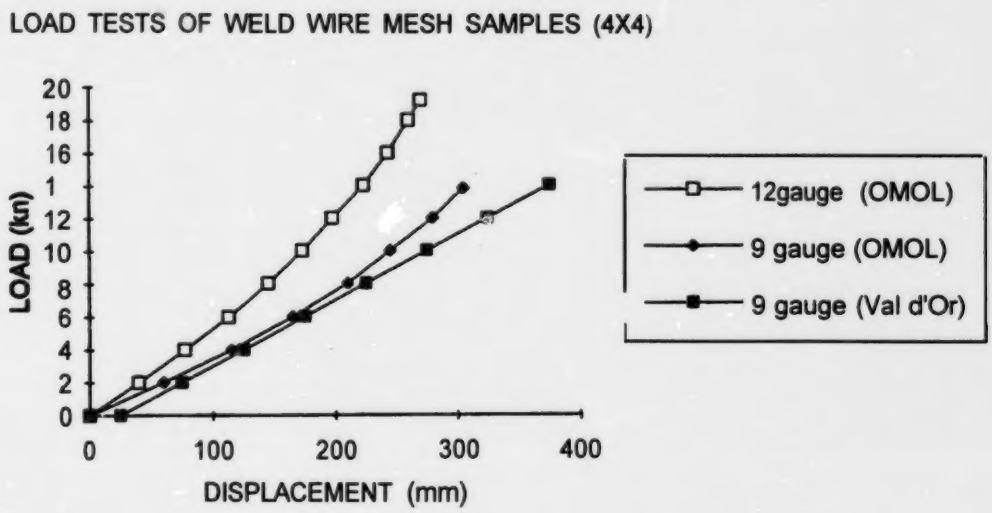

FIGURE 2

AVERAGE LOAD DISPLACEMENT CURVES FOR TENSAR AND WELD WIRE MESH

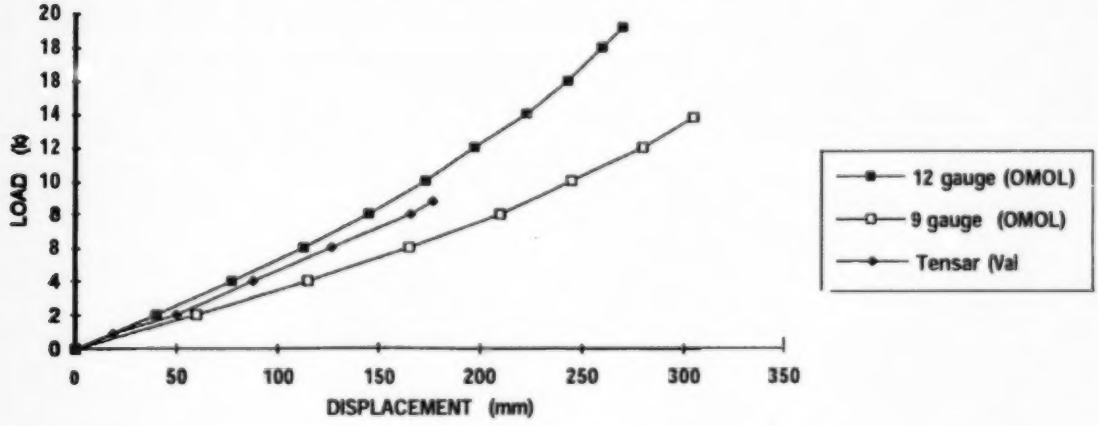

FIGURE 3

Photo 2 Test apparatus - tension meter and loading device

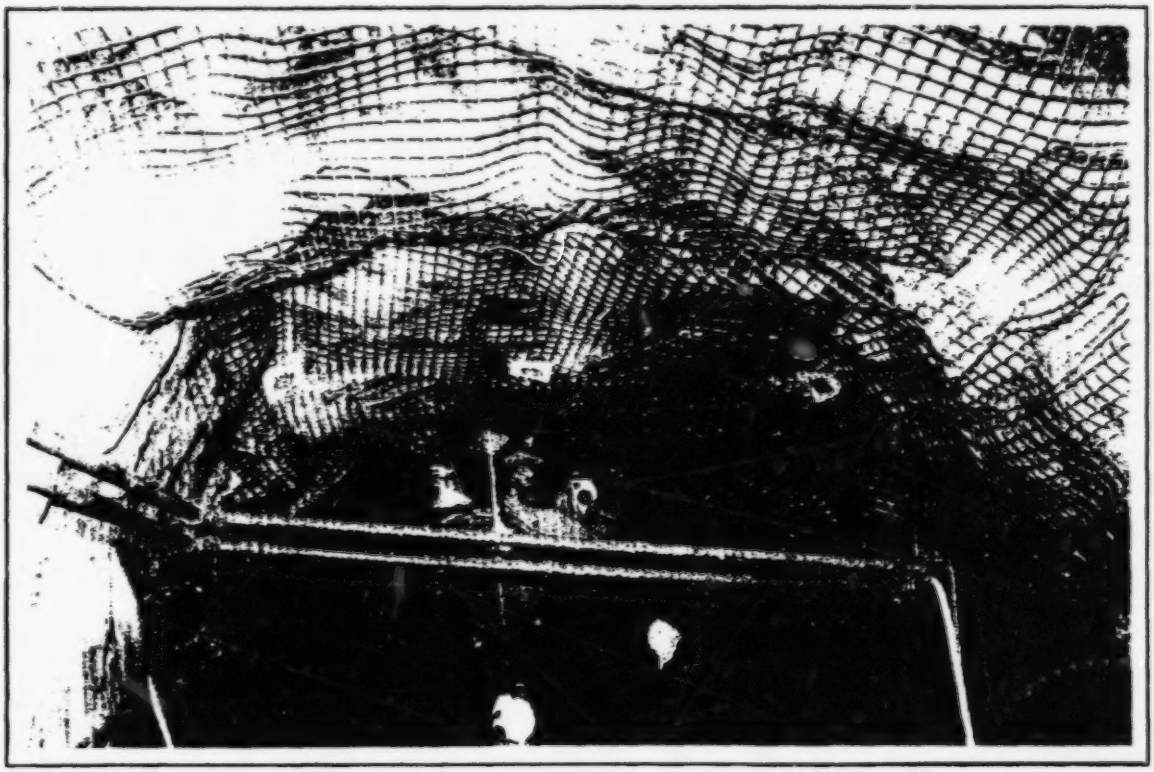

Photo 3 Tensar polymer installed along back of CANMET's Experimental Mine at Val

DEMONSTRATION OF POLYMER GRID AS A MUCK BARRICADE

This demonstration. like the previous one. is not a precise experiment. bur it does illustrate the potential application. A muck barricade was constructed beneath the brow of an abandoned transfer raise using four cable slings across the entrance to the re-muck bay (Photo 4). Polymer grid was attached to the cables using nylon tie wraps. The edges of the grid were drawn back towards the draw point Muck was dropped down through an empty slope 60 ft. The photographs clearly show that the barricade was able to contain muck.

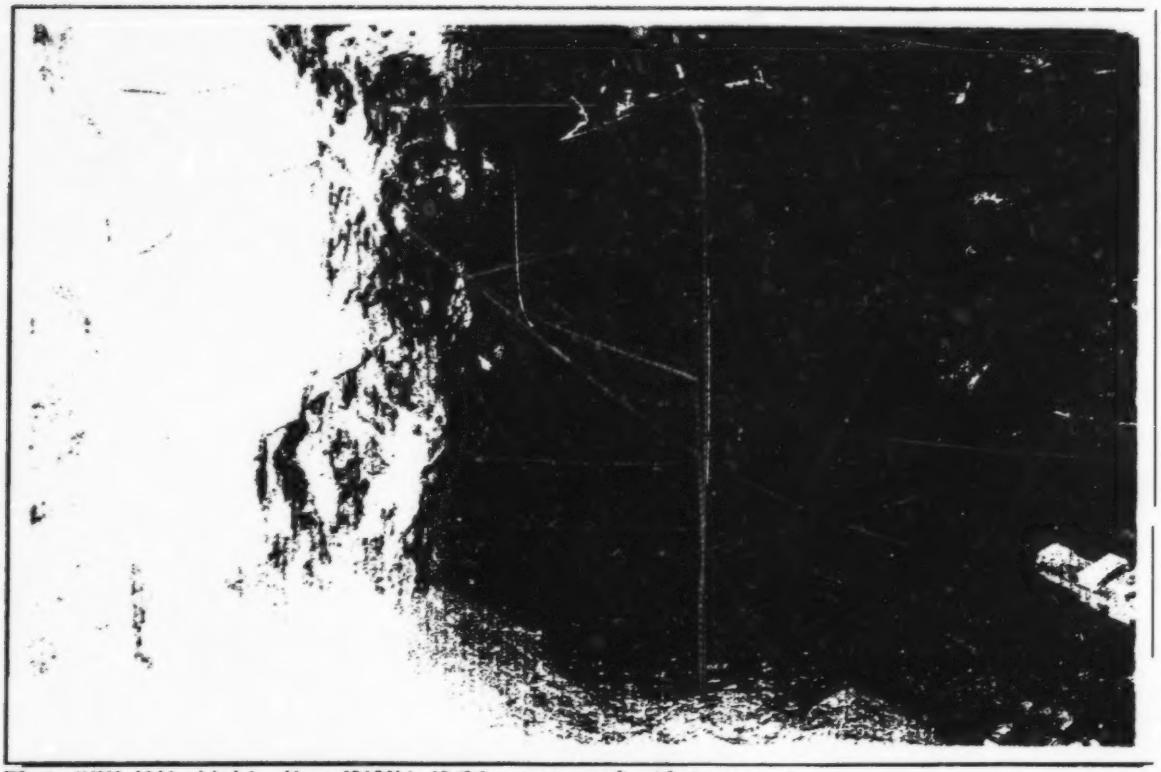

Photo 4 Muck barricade, about 10 ft by 10 ft constructed with tensar

DISCUSSION

Tensar polymer grid is a material finding increasing application in the mining industry. Its lightweight and pliability make handling and installation of large rolls easy. Resistance to corrosion is another benefit, this is especially important in environments that are not uncommon in hard rock mines.

Load bearing capacity of the polymer grid was found to be about 65% that of 12 gauge 4 in x 4 in. weld wire mesh. This equates to a load of 2000 lbs f. Considering this capacity in the context of mining operations, the question that comes to mind is whether this 2000 lbs f strength is sufficient to contain the rock loads to which it might be subjected.

When mesh is used to contain rock falling between bolts, a two-stage approach is used for safety. -Firstly, the mesh is installed to contain debris. Secondly, if material accumulates in the mesh and causes the mesh to sag, the material is removed and the mesh reinstalled.

Therefore an important consideration is the amount of loading or sagging that is acceptable before the debris must be removed for safety reasons. Consider a 500 lbs f load of debris. This is without question a significant amount of load and would cause serious injury or fatalities if not contained. This state of loading would require removal and re-screening.

The polymer grid is able to withstand the load with a safety factor of 3 to 4. Weld mesh has a higher load bearing capacity, but is subject to corrosion. After two years in a corrosive environment the capacity of the weld wire will be reduced and potentially even eliminated.

Tensar polymer grid does have application in the mining industry. Site specific conditions and miner's skill and experience play an important role in choosing the most appropriate support methods. Ease and speed of installation coupled with its non-corrosive properties make polymer grid an option for consideration when screening.

CONCLUSIONS

Tensar polymer grid has an average load bearing capacity of 2000 lbs f when tested by the method developed by OMOL.

Tensar polymer grid is a lightweight pliable material that is easier and quicker to install compared to weld wire mesh.

RECOMMENDATIONS

Since one of the major benefits of the Tensar polymer grids is its non-corrosiveness. An experiment should be conducted to **quantify** the behaviour of the polymer grid and other commonly used mesh in corrosive environments.

A major factor in choosing the appropriate mesh material is of course the cost of the material and its installation. Installation costs of the polymer grid will be lower then weld wire due to ease of handling and pliability. Identifying the cost savings should be determined by comparing the installed cost of the polymer grid with the installed cost of weld wire mesh.

REFERENCES

1. Pakalnis, V. and Ames, D. "Load tests on mine screening", Ontario Ministry of Labour (OMOL), 1983.